

NOTE RE THIS TRANSCRIPT: --

With the exception of an occasional doubtful spelling of a medical and/or technical term or a proper name, this is a verbatim transcript of Dr. Lederberg's extremely interesting and thought-provoking address.

THE TRANSCRIBER

INTERVENTION: THE PROMULGATION OF THE GOOD

Lecture by DR. JOSHUA LEDERBERG

Monday, May 8 at 8:30 P.M.  
Caspary Auditorium  
The Rockefeller University  
66th Street and York Avenue

1972

Professor

MAN (ALEC): ~~PROFESSOR~~ Lederberg, ladies and gentlemen:

*Blum*  
Throughout human history, the need to interlace medicine with the economic and social framework of the day has been a postulate more implicitly assumed than explicitly stated. Yet, despite the inwardly directed, somewhat harassing day-to-day activities of a busy department of medicine, in which the ingredients ~~of~~ research, health care and education are juggled uneasily in an atmosphere of fiscal impedance, the need to spend some time explicitly considering the interrelations between biomedical sciences and the public weal has never been more pressing.

The influence of society on our medical and scientific research needs to be evaluated just as rigorously as the more conventional reverse considerations of the effects of science on society. For more than five years, it ~~has~~ <sup>has</sup> been my hope, and the hope of others in the department, to inaugurate a series of lectures in which these themes could be explored by one whose concerns extended beyond the narrow professionalism of the biomedical sciences to embrace the larger picture.

We are gathered here this evening because this hope has, after five years, been realized by the generosity of one who, as <sup>Chairman</sup> ~~President~~ of the Columbia Broadcasting System, understands as few others do the science and art of effective communication. Mr. William S. Paley, whose warm friendship with Doctor Jeremiah Bar<sup>d</sup>andess(?) has furthered his interests in the goals of our department, and whose generous support has enabled a series of lectures to come into being, had hoped to be here this evening. Unfortunately, he is not able to be with us.

We're exceptionally privileged to have as our first William S. Paley lecturer one whose scientific contributions are massive, and whose knowledge and interests range far and run deep. Doctor Joshua Lederberg is Professor of Genetics and Biology <sup>at</sup> ~~Q~~ the Stanford University School of Medicine. His research on genetic recombination and the organization of genetic material in bacteria was recognized in 1958 by the Nobel Award for medicine and physiology, in which he shared in that year with George Beadle(?) and Edward <sup>Tatum</sup> ~~Tate~~ (?).

But it is not only for his scientific contributions, unique as they are, that we hoped he would agree to address us this evening. Joshua Lederberg has the gift of tongues. As an articulate, literate and rational spokesman, he has transmitted the spirit and art of science to those in our society for whom science is not a primary concern. And since

it is our hope that this series of lectures will aim at communicating with a larger public and a broader <sup>sphere</sup> ~~XXXXX~~, Doctor Lederberg is superbly qualified to speak to us tonight.

He has chosen for his title "Intervention: The promulgation of the good." It's a great pleasure and honor for me to introduce the first William S. Paley lecturer, Doctor Joshua Lederberg.

LEDERBERG: Thank you, Alec. Friends. In putting my thoughts together for a presentation this evening on such a pretentious subject as science and society, I found that I could well use all of my time in apologies for my presumption, or folly, in accepting an invitation to speak on such a subject, with all of the added peril of exposing myself before my friends. My super-ego won't let me get away with such an easy evasion, and it may be the only way to answer my own question, "What am I doing here?" if I just get down to the substance rather than apologizing for how I'm in this fix.

I do have to say that I ~~have consciously~~ <sup>am</sup> ~~I'm~~ <sup>bring</sup> consciously aware that I ~~XXXXX~~ much more zeal than insight into pursuing questions ~~XXXXXXXXXXXXXXXXXXXX~~ about the value of science; and I should say, that as a personal apologia, that one of the arousing stimuli for my concern about the question of value rather than content was the fear <sup>that</sup> ~~the~~ molecular biology might be harnessed to a military technology race with a many-sided escalation of research and development <sup>of</sup> ~~on~~ biological warfare.



cultivated jointly by social, physical and biological scientists? What are its present resources and prospects? And after a rather dismal prospect of the past and an optimistic evaluation of what Professor Barber<sup>(2)</sup> ~~has~~ <sup>has</sup> to say in his present work, he goes on to say that the relative neglect of this subject by physical and biological scientists perhaps requires little explanation; after all, specialization in science calls for devoted concentration of effort, and the sociology of science is not their métier. That means: not mine.

Hard at work on research in their own science, they're scarcely in a position to take up yet another life as sociologists. Furthermore, current practices and assumptions in the world of natural science may militate against their developing even a casual interest in the linkages of science and social structure.

For example, there may <sup>prevail</sup> ~~prevail~~ among these scientists the assumption that the history of science is comprised <sup>of</sup> ~~by~~ a succession of great minds -- an assumption with an easy plausibility, since turning points in the history of science are indeed commonly associated with great scientists. Standing on such an assumption, scientists may readily lose sight of the less visible social processes which play their indispensable part.

In paying its homage to these great minds, society may

inadvertently reinforce that assumption. Eponymy, the practice of affixing a scientist's name to his discovery, as with <sup>Boyle's?</sup> Burroughs' ~~XXXXXXXXXX~~ (?) Law or <sup>Planck's</sup> ~~Plank's~~ (?) Constant, Nobel Prizes and lesser testimonials, and nationalistic claims to scientific preeminence, which lead to a focus on the <sup>contributions</sup> ~~XXXXXXXXXX~~ of one's own nationals, the virtual anonymity of the lesser breed of scientists whose work, Professor <sup>Merton</sup> Merton (?) postulates at least, is <sup>indispensable</sup> ~~XXXXXXXXXX~~ for the accumulation of scientific knowledge -- these and similar circumstances may all reinforce an emphasis on the great men of science and a neglect of the social and cultural contexts which have significantly aided or hindered their achievements.

I have to add, there is another problem about the difficulty of the further pursuit of the area, which Professor <sup>Merton</sup> Merton (?) himself was so important in pioneering, and this is an effect that I believe I have read has been attributed to Dante, for having stultified the further development of Italian literature for many centuries by the sheer magnitude of his intellectual <sup>accomplishment</sup> ~~XXXXXXXXXX~~. This is otherwise called "He's a hard act to follow."

I will have more to say about the role of the social sciences as disciplines in the pursuit of this subject a little later on. Meanwhile, after having had considerable agonies about the chaotic structure of what it was that I had to present, I found that I could proceed with somewhat wiser

resignation if I admitted that I did not have an explicit theory of Western culture -- and one would certainly be needed to help trace the influence of scientific knowledge on that society which is the subject of our discourse.

I perhaps can be slightly less apologetic, although not less pained, if this then excuses me, to describe my remarks as discursive criticisms, and I will be most happy of all if they are really provocative so that a professional scholar in this field can attain a new level of synthetic formulation in response to these scattered remarks.

Since this is to be -- this is -- my own words now are -- an inaugural lecture in a series that I hope will have some continuity and a serious consideration of the impact of science on society, I may perhaps be <sup>privileged</sup> ~~permitted~~ to suggest a program for the further development of the subject. First of all, we <sup>consider</sup> ~~have to~~ <sup>actors(?)</sup> ~~consider~~ various actions. The one you have in front of you represents one category of amateurs. We have no method whatsoever, by the standards of social science or social philosophy. We know something about one piece of the subject, and we have every man's perfect knowledge about the way in which society runs and works, and particularly ought to run.

Social scientists are an important roster of candidates for such discussions. There are not many that can be found further than fifty miles from this location, but there are a great many within this purview who, I think, could comment



much more cogently and knowledgeably about many aspects of this subject than I could. They may perhaps be a little bit overwhelmed by the demands for empirical verification in a field that does not lend itself very well for this. One of the paradigms of social science in some of its manifestations is to imitate physics, or even biology, as closely as possible.

Complex systems do not always lend themselves to explicit statistical analysis and verification when it comes to the most important issues, and there is always a tension deciding about ~~whether~~ whether to work on something important or something unverifiable.

We then have social philosophers, of which ~~there~~ are many, and among whom there are some who could offer a great deal that would be of most <sup>cogent</sup> ~~important~~ relationship to our subject. And perhaps the best that you could find would be those who have dabbled in all of these areas. A social philosopher who has not known what it is like to attempt an empirical study in the social <sup>sciences</sup> ~~studies~~, and has not known the flavor of discovery in the natural sciences, may not be well equipped to discuss at least half of the equation that relates the impact of science and society.

A program for the study of science and <sup>society</sup> ~~society~~ might also discuss the institutional framework that could maximize the final output -- and I perhaps will have some time to come back to that, but I will leave it to you to answer the question

whether an annual lecture, even by an amateur, is likely to result in a great furtherance of our understanding and knowledge of the field.

A remark about the standing ~~of~~ <sup>of</sup> social science, strictly and narrowly considered, and its relationship to studies of science and society. I find it remarkable that the epochal works in this field are done by people like Professor <sup>Merton</sup> Merton(?) and Professor Barber(?), who are eminent ~~social~~ <sup>social</sup> scientists, and who, when they write on this subject, are, in fact, speaking social philosophy.

There is a considerable effort of social science, naturally considered, in fields that are connected with science. But I'm rather perplexed to find how sharply it has focused on the social organization of science as a discipline and as a profession, and that means that rather than its content, it ~~is~~ <sup>is</sup> the system of prestige and power and awards and reinforcements, as seen by the layman, that has preoccupied the major attention of empirical research in this field.

This ~~is~~ <sup>is</sup> obviously a very important subject, especially since scientists sometimes tend to pretend that these matters don't exist, and to pretend that they operate as ~~autonomous~~ <sup>autonomous</sup> entities in search only of the truth, without an understanding of the perturbing mechanisms that may be added on as a super-structure towards that particular pursuit.

But I do have to ask whether such studies on the status

systems of a subject like science <sup>have</sup> anything more to do with the actual content of good science and what it can do for society than a study of political power would have on the quality of poetry -- and I think there is much in common between these fields.

And I realize that measures -- that the intellectual currency of scientific ideas does not lend itself to easy statistical evaluation, but I simply do not see how we can really further the understanding of science, even as a social phenomenon ~~phenomenon~~, without going more deeply into its actual content than more than a very few investigators from the social sciences have attempted to do.

I realize how difficult this is for the non-expert. It poses the complementary problem to what I quoted from Professor <sup>Harlan</sup> ~~Mertin~~ (?); the natural scientist seeking another life in social science would have his counterpart in the social scientist trying to get into the actual substance of the fields that he was addressing. ~~(THE VOLUME HAS DIMINISHED CONSIDERABLY)~~ Is that working all right?

MAN: ~~(OFF-MIKE)~~ Put it on.

MIKE

LEDERBERG: ~~(AFTER SOME/ADJUSTMENT)~~ That's a new switch. Take it off is what I've usually heard about. (LAUGHTER) And it is difficult for me to see how this goal can really be accomplished without following the precept that was mentioned in my quotation from Professor <sup>Harlan</sup> ~~Mertin~~ (?) about teamwork between

biologists and physicists and social scientists in exploring the actual content and the ways of reaching the goals that the scientist has reached. There are very few studies in this field. I don't have a list of them, but it would be a short list I can number on one hand.

I can think of the work of one of Professor Barber's (?) former colleagues and students, <sup>Renée</sup> ~~Rene~~ (?) Fox, for example:

Experiment Perilous, a book about the operations of a medical research team that involved a very close collaboration with such a study.

Because of the difficulty of cross-disciplinary collaboration, the idea of a sociology of sociology has a certain appeal, and I suppose there's a certain mischievous malice in thinking that perhaps the status system and the values and the rewards and the empty trappings of another field deserve just as much attention as do those that win the Nobel Prizes in biology and medicine and physics.

But there's also some substance to this notion, and I would say that work like that of David Krantz (?) on the schools of psychology is a very exciting step in that direction, as a self-examination of the structure of a field, of the development of aspects of thought within it, taking account of and <sup>methodologies</sup> ~~methodologies~~ using the ~~methodologies~~ of the social sciences and not being merely poetic in the intellectual criticism of the content, but not being unaware of it.

Meanwhile, I'm sorry to say that a bit of rather bad history is already being written about events in fields like molecular biology that are within my own recollection, and in large part, again, for lack of effective <sup>contact?</sup> content with the actual participants and workers in the field. I'm referring to a piece that Wyatt(?) had in Nature just some few weeks ago about the response to the discovery by Avery, within a few steps from here, that DNA was the effective agent in the pneumococcal transformation, and which I believe he has totally misinterpreted. However, I will be speaking more about that subject tomorrow afternoon.

Far from being critical about the role and purposes that the social sciences can play, there are many urgent challenges to them in areas that have much to do with the details of the operation of the nitty-gritty scientific work. And I'm rather puzzled, for example, that as far as I'm aware, there has never been a serious study of the functioning of the grants-review committees of the National Science Foundation and of the National Institutes of Health. These are operations in which I have spent many months and years of cumulative effort, and many others of you have as well. They are extremely interesting social phenomena. They represent attempts at the evaluation on single unidimensional scales of the efforts and labors and aspirations and potentials of different groups of scientific effort, and I'm not sure that

anyone really understands what those priority scores mean, how they can be related from one field to another, what are the social dynamics of the process by which such evaluations are made -- and yet, these lead to decisions that are very much the stuff of what social policy about the actual content of science is going to consist of.

In the sociology of medicine, we have many studies that are more <sup>sharply</sup> ~~specifically~~ focused on here-and-now problems, and I think have made an important contribution to our understanding of the nature of medical care, and <sup>we</sup> ~~we~~ now understand that there's something more than the availability of the service, of a health service on the counter, that's involved in the effectuation of care in a population. But we still do not have a meaningful index of health; and lacking that index, we really have no way to evaluate what our purposes are, or to assess how well we are doing in what involve multi-<sup>billion</sup> ~~million~~-dollar investments, a great deal of social dissension and the commitment of the careers of many, many people, including many here.

I think this is a task which certainly requires the skills of the social scientists, since I think we have long gone past the view that there is any single <sup>physical</sup> ~~physical~~ parameter <sup>could</sup> ~~could~~ that ~~could~~ define what we mean by the <sup>health</sup> ~~health~~ of an individual or the health of a population. The perceptions of large numbers of people, as molded by forces that go far <sup>beyond</sup> ~~beyond~~ their objective biological status, are not only important in that

evaluation, but from all that we know about, for example, psychosomatic medicine, also feed back very closely into our actual state of health.

And finally, there is one pervasive policy problem, which I might label generally as behavior under risk, which connects matters like insurance, the safety of drugs and food additives, legal liability for negligence or for malpractice, appropriate policies that balance environmental hazards against economic benefits, traffic accidents, and even such matters as the validation of scientific statements out of the laboratory, as the expression "Gambling With Truth," the name of an excellent book by Isaac Levy, would indicate. And this is a subject which has only begun to reach the level of attention that it deserves in confronting the perception that people have, and the appropriateness and the rationality of their behavior, when there are only probabilistic judgments that can be made out of the outcome of a series of alternative policy judgments.

It pervades all of law, all of the scientific basis for regulatory policy, and we understand very little about it except that it's very hard to see the rationale for why people at the same time will buy insurance on an airplane that takes them to Las Vegas. (A RIPPLE OF LAUGHTER)

I could suggest an agenda for studies that deserve early  
or  
priority, ~~XX~~ at least as a general framework in a program on

science

~~science~~ and society; but basically speaking, they have to do with the sociology of knowledge and its converse. The sociology has been much talked about by sociologists, at least since Mannheim(?), and roughly speaking, they have to do with the question of who knows what, and why -- what <sup>it</sup> ~~is~~ is that leads to the availability of certain categories of expert knowledge in different elements of the community.

<sup>realize</sup>  
I ~~realize~~ I'm oversimplifying description, but I'd also like to suggest the converse issue, which is: so what? What are the consequences to the social order of the differential distribution of knowledge within a social system, and of the intrusion of new information within that system? I'd call the latter the problematics of science, or the problematics of technopathy, if you want to take a pessimistic view of the matter -- the social impact of knowledge.

Since the lessons of Genesis and of the myth of Prometheus, it's been apparent that students of culture have always had some ambivalence about the value of knowledge; and the easy presumption that we as scientists have, that it is always better to know more, is a rather modern phenomenon, and still one rather isolated. It is one shared by a minority of the world's population, and perhaps not much more than a bare majority of Western society. And I think we should not take it for granted that it is better for a community that there be more knowledge in it, and certainly not without having some



knowledge  
further specification as to what that ~~KNOWLEDGE~~ is and where  
it's distributed.

Now my own prejudices are all in favor of <sup>knowing more</sup> ~~KNOWLEDGE~~,  
and I think I'm able to justify and rationalize those prejudices  
on a further examination of the issue, but those judgments are  
necessarily tempered by some of the fears that I've mentioned  
earlier, and I know that some of you have in other directions,  
and I'd like to put it as a matter of careful~~ly~~ analytical in-  
vestigation to see if we can provide an outline of the ways  
and the regions in which more knowledge is good or bad. This  
will involve an exposure of your <sup>premises</sup> ~~premises~~ about what consti-  
tutes good and evil, but we'd certainly be better off for it.

I'm a little puzzled to find very little work on the  
question of the then polemical exercises, and it's very easy  
to find the scientists marshaled on one side and the anti-  
scientists marshaled on another, merely repeating what they  
started out with. We'll find the Mumfords and the Charlie  
<sup>Reich's</sup> Reisches(?) and the <sup>Roszak</sup> Roschachs(?) all talking about all of the  
evil consequences of the objectivization of the world picture  
of <sup>truth</sup> ~~the~~ pursuit of the scientific-~~truth~~-oriented ideal as op-  
posed to the humanly-oriented opposition that they then pose.  
And conversely, there are any number of equally defensive re-  
actions against such sets of propositions.

I'm not aware that there has been a studious effort  
to look at the problem, if not empirically (which would be

very, very difficult; <sup>we</sup> ~~we~~ don't have global experiments at our disposal to compare cultures in which this amount of science has been permitted and others in which some has been restricted; there are usually too many other <sup>confounding</sup> ~~extraneous~~ variables), but I think it is a matter that is capable of deeper analysis than it has received, and certainly in less polemical fashion than it has received up to this time.

After we have disposed of these grand issues of the basic values of knowledge and of the social forces that are concerned about the kind of knowledge that different elements in the community will seek and will have, and why, I think we will be better able to get down to some of the political and resource-allocation issues that face us, that face the Congress, that are so much the concern of those who are looking for some formula by which to assess technology, by which to know whether an SST is going to be better or worse, or to know whether 100,000,000 a year or 500,000,000 a year should be spent on large accelerators, and so on and so forth.

It is not impossible to answer such questions without the prior insights of a more global overview, and usually they are answered without such <sup>insights</sup> ~~insights~~, but I think we would be better off if we understood better the general framework of our problem.

Before I go into my own amateurish efforts at scanning the converse of the sociology of knowledge -- I don't even know

what to call that that would receive ready recognition -- I find myself obliged to listen to an inner voice that cautions about the authenticity of the pronouncements that a scientist is obliged to make. Jacques Gounot(?) <sup>M. NoD</sup> has spoken very eloquently about this in referring to authentic discourse. He does not dispute the right or the obligation of the scientific expert to speak on questions of <sup>values</sup> ~~values~~, or morals, of ethics, of aesthetics, and so on, but he does demand, as part of the inner rationale of science, that there be a clear identification of those premises and of those statements, that when a scientist does speak out ~~on~~ an issue where his credentials and prestige of himself and of the community from which he arises, that he take pains to distinguish what it is that he does have some special knowledge about, and why, and wherein he is speaking as another hopefully thoughtful citizen, but with no more authority, no more authenticity in his pronouncements, than would be the next <sup>man's</sup> ~~man~~.

And that inner voice also tells me that there are a few matters on the public scene where my experience as a geneticist has a certain relevance, where there is some factual information or rational analysis of a situation, that may have some bearing on an important public discourse. And I think before I go on to the very much more speculative items that I would certainly label as subjects more of my avocational and passionate interest than one to which I can claim any degree of

professional authenticity, that I should say something about these subjects -- and I will pull them out of the day's news.

I think many of us felt that the <sup>problem</sup> ~~problem~~ of abortion had been laid to rest reasonably effectively with the passage of the liberal legislation in the State of New York, and were rather astonished at the reversals that have been suggested by President Nixon's recent <sup>statement</sup> ~~statement~~ to Cardinal Cooke on this particular question. I suspect that this will help to fuel a very considerable reexamination and reaction to liberal laws like those of New York State, and may cause very considerable difficulty indeed in other states which have not yet proceeded to this step. I hope that my language conveys <sup>clearly</sup> very, very ~~clearly~~ where my biases are on this ethical question, but I'd better come out and say very, very clearly that I do have value judgments to make on this matter that are independent of my views as a biologist, and that the impairment of a woman's right to an abortion at an early stage of her pregnancy is, in my view, an intolerable inference with the disposition of her own body.

This is obviously very much connected with another ethical question; namely, when does that right of disposition of her own body interfere with the rights of another human being? -- which is the same as to say, when, in the development from a fertilized egg, do we now have a human being no longer a part, a dispensable part, of the woman's own body?

That is not a question to which biologists can <sup>afford</sup> ~~afford~~ a very  
 specific answer, since we have no scientific <sup>criteria</sup> ~~criteria~~ that  
 define when is a human being. I have no exterior statement  
 to match that up against. We will each speak from a certain  
 set of convictions and feelings on that <sup>question</sup> ~~question~~, and I think  
 that the argument should center on precisely that issue. I  
 think none of this would deviate very strongly from one form  
 or another of Kuntz' categorical imperatives; and that is that  
 in our dealings anywhere within the world, that we deal with  
 people as very <sup>special</sup> ~~special~~ subjects, we do not deal with people  
 as things. The question is, when is a people, when is a  
 person? And this is certainly a matter of very considerable  
 controversy.

What I can point to, speaking as a biologist, are some  
 of the consequences of adopting a view contrary to the one  
 that I've espoused. For the sake of argument, let us consider  
 the consequences of the point of view that the fertilized egg,  
 or that the early foetus or some comparable stage that is now  
 regarded as within the legitimate sphere of action of a woman  
 and her physician in conducting an abortion, <sup>is not</sup> ~~but~~ what are the  
 consequences of regarding a conceptus as a human being, not  
 necessarily cloaked with all of the Constitutional privileges  
 of citizenship, since minors do not have all of the Constitu-  
 tional privileges of citizenship. One does not even have to  
 take the view that abortion is equivalent to murder to ask

the question whether there is some element, important element, of personality inherent in the early conceptus.

Taking the narrowest possible view of the statement of privileges and rights to human existence of the conceptus, I have to point out that there are and would be very grave consequences indeed to the rest of our way of life, and to our further proceeding in medicine, were that hypothesis to be continued. The biological data, which <sup>are</sup> ~~is~~ very familiar to all students of human reproduction in a scientific sense, is that for every four pregnancies that reach term, there is at least one conceptus that fails, that will abort spontaneously. This number -- this is a low estimate. The <sup>plausible</sup> ~~probable~~ estimates of reproductive wastage through early foetal loss range anywhere from 25 to 50 percent. It is very difficult to estimate the frequency of very early losses of fertilized eggs and very early embryos that do not even achieve nidation.

I would like to point out that the view that these conceptuses have a right to live would impose an obligation, a moral obligation upon us as human beings, towards them if this is to be consistent with our views towards other human beings, that we are not likely to fulfill~~ed~~, and that if we were to attempt it, would result in utmost disaster.

One of the <sup>disasters</sup> ~~harmful~~ that would be a consequence of such an attempt arises from the fact that a considerable part of ~~of~~ this foetal wastage, perhaps a third, is represented by

conceptuses that have a grossly abnormal chromosome constitution. Some of these are so grossly abnormal that they simply could not survive delivery and birth even were they to reach the stage; but others are of kinds that we can recognize as rather serious monstrosities which are, however, capable of living. There is a high proportion of trisomies<sup>(2)</sup>, a high proportion ~~XXXXXXXX~~ of X-chromosome variations among these conceptuses that are filtered out at present by some natural process of selection against them.

But we would be very hard put, <sup>since</sup> ~~XXXX~~ we do encourage <sup>Klinefelter's</sup> Turner's<sup>(2)</sup> syndrome and Kleiner's(?) syndrome and other anomalies of various degrees; we do not regard these persons <sup>Were</sup> as candidates for infanticide. ~~XXXX~~ we to make no distinction between the personal rights to existence of the conceptus and that of a baby, I don't see how we could draw any very clear-cut line between the survival of such conceptuses and those that have apparently normal chromosomal or genic constitutions.

So the first consequence of the consistent pursuit of a policy that says the conceptus is a human <sup>being</sup> ~~XXXX~~ would, morally speaking, have to be a very diligent effort to conserve ~~XXXX~~ that life which is now wasted. I'm not putting a moral opprobrium on allowing that life to disappear when we have no knowledge of it, but I simply do not see how we could consistently stand by and complacently allow it to happen if it were cloaked with the moral attribute of humanity which is

connected with that hypothesis.

Furthermore, I presume that there would be a considerable moral imperative to proceed with further investigative work which would allow for the survival of fetuses of a kind which now spontaneously disappear. This would be succor to the sick and ailing of a kind that we do not now deny to other <sup>stages</sup> <sup>development</sup> later ~~stages~~ of human ~~development~~.

Alternatively, we might have to put a categorical end to further research on maintaining pregnancy under conditions of threatened abortion, since if we ever do reach the point where we have the option of allowing a damaged conceptus to survive, I do not see how we could be morally entitled not to use that knowledge, and in those circumstances we'd better not have it.

Now this is not an absolute and categorical answer to the assertion that abortion should be made illegal. It is pointing out some of the consequences of pursuing the philosophical concept on which much of that argument rests. And I do not think that we believe, although this is a presumption and on the other side~~W~~ of the line of an authentic discourse -- this is a moral judgment -- but I do not believe that the community really wants to set us on a path that will result in 20 to 30 percent of our live births consisting of overt monstrosities -- and yet, I see this as the inevitable logical consequence of a consistent pursuit of that ~~philosophical~~ philosophical



precept.

There may be arguments on the basis of which the question of the law of abortion should have been considered in the first place, or should now be reconsidered, but I hope that if this precept is used as the basis for it, that its consequences are very carefully thought out.

To turn to a distantly related subject, I have been told of an editorial in the Journal of the American Medical Association, which the press has taken up, quoting the Journal rather than an anonymous editorial writer, as having taken a very strong stand favoring a moratorium <sup>on</sup> ~~of~~ research related to transplantation of ova in man. The bases for examining that question, I think, are fairly straightforward. Manipulations involving the fertilized egg in vitro theoretically do stand some risk of unintended damage to the ovum and the possibility, therefore, of disruption of development, and possibly of congenital malformation at the ~~the~~ outcome.

And I would certainly be the first to say that one could hardly morally pursue an investigation of this kind in man without taking very careful account of the risks that are inherent in the procedure along the lines that I've just indicated.

Before we put this in a category of a negative categorical imperative -- and an editorial demanding a moratorium would appear to be in that situation -- I would think it would,

however, also be necessary to point to a number of other situations in which there are either grave or unknown risks connected with the future of a fertilized egg.

For example, among the techniques of contraception that are still widely advocated, and that some believe to be preferable from the point of view of both <sup>maternal</sup> ~~maternal~~ and foetal safety to the use of <sup>hormonal</sup> ~~hormonal~~ interventions, are the use of spermicides. Traditionally, these range from distilled water to substituted quinalines<sup>c</sup>(?). I am simply not aware of any reliable study on the possible teratogenic effect of any of these agents, including distilled water, as they might be applied to sperm, and as they might be expected occasionally to be ineffective in the <sup>prevention</sup> ~~prevention~~ of conception. And I very seriously would place just as grave an interdiction on such manipulations of sperm prior to fertilization as I would on the transfer of fertilized eggs. There is no reason, <sup>more</sup> a priori, to believe that these stages are ~~more~~ or less vulnerable to ~~chemical~~ <sup>chemical</sup> and physical insults from exterior sources. And I simply wonder why no fuss whatever has ever been made of this question, when the question of an oval transplant to a woman desiring a child by her own husband ~~and see~~ -- who may have the opportunity to circumvent a blockage of the ~~Fallopian tubes~~ Fallopian tubes by surgical transplantation of her ova after in vitro fertilization becomes the subject of so much comment.

And finally, I would also have to remark that the studies over many, many years of Witchy(?) and of many other investigators have shown in experimental material very, very clearly that overripe eggs are very good candidates for congenital malformation; eggs that are maintained too long before ovulation or held too long before fertilization, in a variety of species. This is very clearly known in rabbits. There has been only a little epidemiological investigation on this question in man, since we have so little opportunity to look at the age of an <sup>egg</sup> ~~egg~~ -- that is, how much time has elapsed since ovulation -- that is involved in a given pregnancy, and the results of epidemiological study are, to say the least, equivocal.

This has a certain bearing on other preferred methods of contraception; namely, the rhythm method. The rhythm method has no teratogenic consequence when it is effective, but <sup>plainly</sup> ~~plain~~ when it fails it will be because of some marginal miscalculation about the time of ovulation in relation to the time of impregnation, and at least half of those miscalculations must then involve eggs at the latter end of their period of fertilizability, and therefore also open the theoretical possibility of congenital malformation as a <sup>consequence</sup> ~~consequence~~ of this practice surrounding the point of fertilization.

These are questions of comparable gravity and interest to those of <sup>surgical</sup> ~~surgical~~ transplantation of ova. It's perfectly

obvious why they have not received so much attention. One is an experimental procedure, about which there has been a great deal of speculation about the further social utilities or disutilities of its use in other ways. The other (that is, the rhythm method) has been used, or has failed, for many, many years, and no one has ~~noticed~~ ~~noticed~~ an abundant crop of congenital malformations as a consequence.

I need hardly tell you that not noticing that phenomenon is still consistent with there being a 20 or 30 or 40 percent difference in the incidence of congenital malformations in that group compared to others -- and, just speculatively, you know, that could be many thousands of malformed babies.

A third issue very much in the arena of public attention, and therefore ~~and~~ relating public policy to science, and certainly a legitimate subheading within the concerns of science and society -- concerns the <sup>genetics</sup> ~~phenomenon~~ of IQ. This is a subject on which I have in the past spoken at very considerable length at Stanford, but Professor Shockley(?) keeps talking about it even more than I do, and -- (A RIPPLE OF LAUGHTER) -- he's made a number ~~of assertions~~ <sup>of assertions</sup> that have aroused people in various ways. He asked the National Academy of Sciences to pass a resolution that the heritability of intelligence is a large number. That is an innocuous statement within a well-defined context; it is undoubtedly correct; and of course, all of the mischief arises from a misunderstanding of the

context in which that assertion is meaningful. The assertion is meaningful, just as the concept of heritability is meaningful, only within the framework of a fairly well-defined and fairly uniform environment.

I wouldn't want to insist that lower-middle-class England is a uniform environment, but it is sufficiently unbiased with respect to the distribution of adopted children to do well enough for this purpose. The comparison of monozygotic twins who have been separated near the time of birth, have been adopted into environments that are presumably only randomly related to the environment of their co-twin, is almost the only method that we have <sup>available</sup> ~~available~~ to us for asking and answering the question of heritability. And it is indeed true that within that framework one finds heritabilities of the order of .7 or .8; that is, something over one-half of the variants in the measured IQs of a reasonably homogeneous population of a given ethnic group is likely to be found to be heritable, and therefore stands a good chance of being, in some fundamental sense, of genetic origin.

It is also true that there are phenotypic differences in intelligence between blacks and whites in this country, taken in the large. Roughly speaking, large populations of blacks, taken indiscriminately from around the country, will score about one standard deviation lower, some 10 or 15 IQ units lower, than a comparable population of whites. Both

distributions have the standard deviation that I mentioned, and not even Shockley(?) will deny that there is genius to be found among blacks, as it has sometimes been found among whites as well; but his statement about the <sup>Phenotype</sup> theatype(?) of the American black population is, again, unarguable. And our problem arises when we attempt to put these allegations together, and we must then, of course, part company.

Shockley(?) has made remarks to the effect that he be-  
 not  
 lieves that ~~not~~ only are there variations in intelligence having a genetic basis in different segments of the population, but furthermore, that this is color-coded(?), that therefore the color of a group of individuals has some predictive value in describing not only their intelligence as measured by an IQ test -- and that's an empirical observation -- but also in the assessment of the genetic factors that he asserts to ~~under-~~ <sup>under-</sup> ~~lie~~ <sup>lie</sup> that IQ, and that is not an observation; that is an inference that purports to say that the sources of variance of IQ within a middle-class white population are comparable to the environmental sources of <sup>variance(?)</sup> ~~variants~~ between the white population and the black population of this country.

Not to point that out is an arrant misuse of the word "heritability." The word "heritability" is as "heritability" does within a specific context. And of course, the mischief in passing such a resolution would be the likely failure of public understanding of the meaning of that kind of a statement.

But far beyond that, while it easy, and one might even say appropriate, to be rather angry at racist allegations of this kind -- and there is no <sup>doubt</sup> ~~XXXX~~ about that label; at least I'm certainly willing to stand by it -- in a deeper level, I really wonder what the fuss is all about, and whether it would be regarded as anything more than name-calling if the various parties to this controversy really fully understood the meaning of the statement "the genetic basis of intelligence."

All that investigators in this field could ever hope to accomplish, to learn, would be an enumeration of the genetic factors that will predispose to a given outcome in some specified series of environments. At the present time, we face the socially intolerable and experimentally frustrating situation that these environments are not equalized, nor are they likely to be in the very near future. I really can foresee no circumstance, within my own ambience, whereby a group of black <sup>chil-</sup> ~~XXXX~~ dren could be reared in a completely color-blind fashion. If they're not discriminated against, they're likely to be fawned over, and either is likely to be an egregious insult to their appropriate development -- and as long as we are, as people and as a country, as color-conscious as we are, whether for socially admirable or socially detestable purposes, such experiments simply are not possible.

But, hypothetically, we could imagine, somehow, some specific common environment in which a representative group

of black and of white children might be assayed; and under those circumstances, on that hypothesis, one could measure the so-called heritability of the difference.

And it's perfectly conceivable that if one were to use for such an environment the one <sup>which</sup> ~~which~~ has been that to which the European white genotype has been adapted, that one might find -- this is pure speculation, and I have neither belief nor disbelief; I merely lay it on as a hypothesis that one might make -- that one might find that there would be a detriment in performance of the black children in such an environment.

And one might <sup>equally</sup> ~~equally~~ well find that if one changed that <sup>environmental</sup> ~~environmental~~ regime, and changed the ~~environmental~~ circumstances in which the development of that intelligence were tested, that one would find exactly the opposite outcome -- because even the most precise measurements of heritability, within the context of this kind of a study, cannot measure the innate value of a human soul, even in biological terms. They cannot predict the environmental -- the developmental outcome in all possible environments; they can only give you a retrospective summary of what that development is in an environment that has indeed been specified.

There are observations on black children which are heavily contaminated by environmental bias and are, therefore, totally untrustworthy, but they do give some indications,



which one must treat very skeptically, of early differences in psychomotor behavior, and there may be different patterns of neurological maturation that are controlled by genes that have different frequencies in the black and the white population -- and my answer <sup>to</sup> ~~is~~ that is not exactly "So what?" My answer to that, speaking strictly as a scientist, is that it would be an exciting challenge to know the details of the developmental processes in question, and then, if we chose, we would have a very high likelihood of being able to provide environmental measures that could reshape that development towards whatever ends that community desired.

This discussion has taken no account of whether IQ is good or bad for you, which are value judgments that I don't think I need to go into, but I'm deeply distressed that there is such a fundamental misunderstanding about the word "genetic" when it's applied in a social context, that it has misled many of my friends and has misled many ~~of my~~ liberal social thinkers into getting very much more excited about this entire issue than the matter warrants.

The question of genetic factors in intelligence ought to be looked at in exactly the same light as genetic factors in diabetes or in any other of a number of human traits; and the more we know about them, <sup>the</sup> ~~the~~ more we have the opportunity to provide intervention that may be capable of doing some good in response to what the people in various communities would

like to see. Let me then say I don't think we know anything about it whatsoever; that is, these are pure speculations about the kinds of differences that might pertain to these populations -- and I mention them only to clarify what the nature of the argument might conceivably be about, rather than <sup>assertion</sup> any ~~XXXXXXXX~~ concerning the outcome.

<sup>reason</sup>  
The ~~XXXXXX~~ that few geneticists have wanted to get into this field is not because of any bias against inquiry about the genetics of races in this country, as Shockley(?) has <sup>about</sup> accused us of. The reason is that it appears to be just ~~XXXXXX~~ the <sup>most</sup> rewarding arena for scientific inquiry that one could get into, because the entire question is so heavily contaminated by environmental differences that we really do not know how to assess ~~XX~~ <sup>or</sup> to compensate for.

Well, these are matters in which I think I have the right to speak with some authority; that is, some of my colleagues' faces -- I <sup>would</sup> ~~wish~~ get some apologies on the part of my colleagues if I misspoke -- or some very quick answers from them, I should say, on that matter.

Let~~us~~ me turn very quickly to the outlines of the inquiry ~~XXXX~~ about the impact of science on our culture, that I think does need to be deepened if we're to have some understanding about what the unease is about and what the complaints are all about. This is simply an attempt to systemize a compendium of allegations about what science has done, and I don't

I think I have anything new to report in this way, except to give you a list, and a list that has some <sup>characteristics</sup> ~~characteristics~~ of some kind of order to it.

I will try not to be defensive when I speak cultural situations that are in some measure responses to the introduction of knowledge, and to the development of technology based on that knowledge. And of course, I've already touched on one of the deep sources of confusion in the public reactions to science and technology; namely, the difference between the two. And every scientist here would bristle at being confused with an engineer or a technologist or a technocrat, and I guess most of us here are scientists, or physicians using science in a highly scientific sense, and certainly put ourselves on a very different side of the fence from those who, as the saying goes, would like to pave over America with concrete, or do any of the other technological miracles that are attributed to that other element in our technological society.

That's a reasonable complaint; that is to say, I think those distinctions ought to be made. I think we scientists ought to wince when we are credited for <sup>sending</sup> ~~sending~~ men to the ~~moon~~ <sup>moon</sup>, which we did very little to help, and many of us tried to frustrate, at least politically if not technically, and we don't deserve credit for that accomplishment. We've done very, very little. Those are technological accomplishments of a very high order, and possibly even of greater merit than

I might have thought at some earlier stage in our own national policy. ~~But~~ <sup>this</sup> is an area of public concern, but I also think we can't cop out that easily. As scientists, ~~we are~~ <sup>we are</sup> not that readily disconnected from the technological framework which, by and large, ends up ~~justifying~~ <sup>justifying</sup> the public and social expenditure in the work that we do. And every time any scientist~~s~~ pleads that it is a good idea to fund research or to provide his own research grant because it will have useful results for people's benefit, he is making not a scientific but a technological plea; and I think too many of us have used that argument to be able totally to ~~refute~~ <sup>refute</sup> the connection between science and technology that does loom ~~so~~ <sup>so</sup> large in the public mind -- so there is good technology and there is bad technology, plainly, and we scientists are all in favor of, by definition, good technology.

For this discussion of the impact of knowledge, I can hardly separate the science which by itself, being merely knowledge, can have very little influence except on people's beliefs -- and, of course, what a small thing that ~~it~~ <sup>is</sup> in a culture, in contrast to the technology that builds the bridges and the war machines, and so on.

Well, this is to say that certainly in any schematic analysis of these impacts, the influence of knowledge on the ethical system of man's relationship to God, his understanding of himself, which is another way of saying the same thing, and

of the sets of traditional beliefs that closely control his everyday behavior, still today looms very large as one of the major consequences of the acquisition of knowledge in our rationalist culture.

There's a very pretty parable along this line, and it may even be a true story, although I've not investigated this point, which is given by Loiston(?) Sharp(?) in a book called The Human Impact of Technology, edited by Spicer(?) some while ago, and it has to do with the effect of the introduction <sup>of</sup> ~~now~~ steel axes into an aboriginal culture in Northwest Australia. These were Stone Age people who had lived for many years in a harsh environment and within the framework of a rather elaborate social system in which this primitive tool, the stone ax, played a very important part.

In an intervention intended to do good, at a time after there had been some lethal contacts between colonizing settlers and the aboriginal tribe and a reserve was established for their exclusive use, a mission was set up that began to distribute some of the good of Western technology, and the one <sup>focuses</sup> ~~on which~~ <sup>steel</sup> ~~Sharp(?)~~ ~~XXXXXXXX~~ is the ~~XXXXX~~ ax. The steel ax is <sup>ought</sup> ~~XXXXX~~ obviously a better implement than a stone ax. It ~~XXXXX~~ to make possible an alleviation from toil, the possibility of harvesting the goods of the earth more effectively, and a better life for all the people involved.

Now it's very difficult to isolate this particular

variable from all of the other influences on the acculturation of this group, but it does make at least a rather persuasive parable.

Now it turns out that the stone ax was the center of trade, of the economic life of these people, of their relationships with many other groups, because the stones had to be transported some hundreds of miles for the manufacture of the axes. There would be annual palavers involving the different tribes for the exchange of goods. These were highly festive occasions, which were very meaningful in the life of the people, and they provided some of the important points of -- well, all the things that trade does even in modern society, when you stop to think about it.

They were also the focus of <sup>family</sup> ~~XXXXX~~ relationships. A ~~stone ax could be~~ <sup>skills</sup> ~~the~~ ~~XXXXX~~ for making a stone ax were known to the men, and only to the older men, and they had a traditional right of ownership on them; and the <sup>women</sup> ~~woman~~ and the younger men within the tribe could borrow these axes in order to do the various jobs around the home and the field that ~~had~~ had to be done, but it was always in a relationship of deference and one that led to a degree of stability within the society, particularly as between the women and the men.

There were also totems connected with the stones, and a good deal of self-esteem was connected in the ownership of these axes. The do-good missionaries distributed the axes out

of the largesse of their will, which meant essentially a random distribution, or sometimes in exchange for servile behavior on the part of particular individuals within the group. The women quickly learned how to get out of them, women having skills that you well know -- and everything went to pot.

The relationship <sup>of</sup> ~~XX~~ young to old deteriorated, because in the steel ax, there was no precedent for the unique <sup>language</sup> ~~language~~ that meant that the ax had to belong to the elder. It was another type of object altogether. It was not something that required any special skill to make, and there was therefore the technological obsolescence of that particular craftsman. The trade relationships deteriorated, because there was no longer any need for this relationship between the tribes, and the culture deteriorated absolutely. And I guess we would all see that's a bad thing.

And I suppose that is a parable for what many people believe to be the latest of the consequences of innovation in modern society. Lest any of you leap to too rapid conclusions on this point, one does need to reflect on whether the stability of a culture is always desired, <sup>whether</sup> ~~whether~~ the subservience of women in traditional cultures is one that should always be maintained, as connected with the other totems. There are, as always, ambivalences in our views on such a matter. At least, I hope <sup>there</sup> ~~they~~ are, if <sup>one</sup> ~~you're~~ thinking right.

This parable does illustrate, in some way, the erosive

effect on traditional belief, not only of science, but on technology. If any child has at his command the whole technae(?) of his community and, in fact, if he's likely to know it even better than his parents, we have the post-figurative society which Margaret Mead claims, and which is such an obvious disaster that I think I would be willing almost to accept the prescription of a moratorium in science to prevent it, although I don't think it would.

This is the argument that the old ought to learn from the young, and I suppose it means that mother ought to learn from the newborn baby with respect to how to live.

Attitudes of organized skepticism introduced-- which are such an essential attribute of science -- not only introduced new data that have clashed head-on with traditional beliefs -- and I guess we'd have to go back a ways to look at some of the facts about which there've been such collisions and which are associated with the names of Galileo and Darwin and Freud -- but they also represent a point of view about authoritative statements, which is very difficult for any political or ethical system to survive very long. If every act is going to be challenged, if every assertion is going to have to be rationalized, if every member of a community has an equal right to protest that the lights ought to be red to go and green to stop, obviously social life cannot last very much longer; and there is a very close connection between the



cohesion of a society around traditional authority and the ability to reach this kind of coherence which is necessary for social functioning to continue.

The anomie, the sense of purposelessness which infects so many today, is another all-too-obvious consequence of the disappearance of exterior orientation, and I think science does have to take some responsibility for that outcome.

Now the religious impulse does run, <sup>nevertheless</sup> ~~nevertheless~~, very, very deep, and we'll find that after a period of disruption of one set of religious belief, it's quite natural to see that the Jesus freaks or some other types of sects will soon arise. And I have to say -- I speak quite introspectively, and maybe this is not as true of you as it is of me -- that the scientist very self-consciously sublimates his religious impulses, his sense of the irrational and of things which are purposes that are axiomatic and self-understood and do not require further examination~~er~~ and further criticism, that he can very easily sublimate that within the program of the noble purposes and the very exciting operations of his research.

His assault on nature is very close to coming to God, and there are some theologians who will even congratulate him for that identification. But I think scientists who are actively busy with the framework of their own work are very ill-equipped to realize how erosive the by-products of their investigation are on the mere bystanders, the people who are

sitting by during cultural convulsions and the disruption of traditions and do not have the benefit of this kind of commitment to a goal whose good is evident within itself, which is what I think most scientists will view of their own scientific investigation.

We have similar problems in the aesthetic sphere. I find it quite possible to enjoy a rainbow and simultaneously to reflect on the spectral dispersion of light, and to remember Newton's experiments and his erroneous conclusions therefrom, and so on and so forth. And to me, these are in no conflict ~~XXXXXXXX~~ whatsoever with one another. There are some whose views and feelings I respect who do not share that immunity from the intrusion of a cognitive and rational view of an aesthetic situation, and that is a fact of life that I think we must respect, even if sometimes we don't understand it, and perhaps it deserves somewhat deeper investigation.

I think that another thing that we need to do more than we have is to communicate to a public that is angry <sup>and</sup> ~~and~~ hostile about being deprived of sources of poetic inspiration, some of that poetic inspiration which is part of the <sup>texture</sup> ~~XXXXXXXX~~ of scientific work itself. That's very, very difficult to do when you go very far out in big-machine physics, although I think even there one can still inspire a great deal about the wonder of nature and the -- I'll put it very bluntly: the religious aspects of the scientist's confrontation with nature

in his own investigation. And I think if we fail to communicate that to the rest of the public, we will all suffer very, very seriously, because they ~~■~~ have been facing a vacuum this last hundred years that we have filled for ourselves~~■~~ but we have given them very little in exchange for.

Another level of human systems might be described as ecological the ~~ecological~~ one, relationship of man to nature, to land, to the environment. And here, of course, the dominant theme to discuss is the progress of agriculture, the domestication of crops, a more recent innovation since 9,000 years ago, the mechanization of agriculture, and we have now a community that doesn't even think about the sources of our food. A very small part of our population is devoted to ~~that~~ <sup>that</sup> ultimate source of our goods.

And of course, that wonderful impact of science, the sufficiency of food, is one of the sources of the population explosion, and we have here one of the many paradoxes of ~~quote~~ so-called "progress" ~~unquote~~, which is so-called and which, of course, must be open to question, as any perturbation~~(?)~~ in a large system is likely to result in paradoxes.

I personally do not feel that the environmental problem is an inherently difficult issue for science and technology to deal with. And here I know I'm running very much at odds with Lewis Mumford and a number of other commentators who feel that somehow the pursuit of objective knowledge is intrinsically

and fundamentally associated with the destruction of the earth. I see it as a matter of pure and simple economics. The commons <sup>environment</sup> have been opened for depredation, and the ~~ENVIRONMENT~~ can be exploited for private benefit, although it is a public resource. It's not that anyone hasn't noticed it, although a good deal of it has crept up unawares. We simply haven't <sup>the</sup> created ~~any~~ legal forms and established the property rights to put it under reasonable control.

I think we are learning to do so, and I think that science and even technology is going to play a very, very large role in setting matters again to rights.

There are those who feel that there is somehow some fundamental disrespect for nature and for the earth that's involved in inquiry about nature -- and I merely record the view, I don't understand it; but I think it's important that we know that such exist.

With the development of the industrial revolution, we have had a new layer of the introduction of scientific technique, and we have now, with the replacement of muscles by machines, potential alleviation of toil, just as the development of agriculture is the alleviation of hunger; and this, of ~~the~~ course, I guess toil, with hunger, <sup>is</sup> are generally regarded as evil, certainly when one is too deeply involved with them, and so that here is certainly another measure of human progress.

Here~~y~~ I see a problem we will not so readily evade.

It was the only one in this list that Professor Barber(?) in his book gave very much attention to in his discussion of the impact of <sup>science</sup> ~~SCIENCE~~ on society. It's one that has been given very little attention during the period of environmental hysteria, and I think it's going to recur again as a very deep problem, because it is not just connected with the distribution of economic goods. And this is: how do we deprive a man of a sense of worth in his work, if the progress of knowledge in his environment exceeds his <sup>own</sup> ~~OWN~~ personal capacity to adapt to it?

I think it is a matter of biology that our period of rapid learning reaches its peak at around 16 or 17, and that at least the second derivative, if not the first one, is all negative after that. And we have here, then, a very fundamental difficulty. If people have useful lifetimes and useful work lives that extend far beyond the <sup>cycles</sup> ~~cycles~~ of change that science and technology can introduce, how in the world am I going to keep up with the new techniques in molecular biology? And that is a very deep problem.

I don't think we're going to get around it very easily. There are no gimmicks of economic redistribution that are going to take the place of the sense of worth in a sphere where your worth is diminishing; and I think we're going to have to give very careful thought to the reconstruction of career lines and to the whole notion of what are regarded <sup>as</sup> ~~as~~ esteemed and

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appropriate commitments of people's time and effort at different stages in their career, if we're to really come to serious grips with this problem. I've seen no really serious suggestions that are, in fact, capable of meeting it, and I'm afraid that we're going to be given leisure rather <sup>than</sup> ~~than~~ useful work as ~~a~~ substitute with the increased accumulation and application of scientific knowledge -- and I'm not sure it's a very good bargain.

Another level of organization has to do with the state and the relationship of the citizen to the state, and here we have some remarkable paradoxes. I don't have time to explore them all, but for some reason people are very much concerned that the police have new tools with which to catch criminals. The idea that computers might provide more nearly inexorable ~~XXXXXXXX~~ breakers tools to catch speed-limit ~~XXXXXXXX~~/or income-tax evaders or to find people who may have run away from the law, and so forth, seems very horrendous. And one of our ~~SENATORS~~ <sup>Senators</sup> said, "Humans can forgive, but computers will never forget."

I find it difficult to believe that we want a social system where a calculated fraction of lawbreakers will evade punishment. If we do, then let's set up a lottery. (RIPPLE OF LAUGHTER) And if we don't, I think we need to look at the side effects of the kind of surveillance that's implied by the new technologies that are empowered in the hands of the state, or provide whatever other regulations will meet the

actual and fundamental problem. People resent the idea of a big brother watching them; and obviously, when that kind of surveillance can be put to illegal uses, we may feel very helpless and feel that it must be frustrated at its very source.

I can't help but feel that the question of privacy vis-à-vis the state is misstated, that the same questions that would frustrate the establishment of data banks that are run on computers obviously ought to apply to the existing bureaucracies ~~XXXXXXXXXX~~ and the files on paper that occupy much more room and are just as likely to ~~XXXXXXXX~~ contain fallacy or error or malice, regardless of the medium on which they happen to be recorded ~~XXXXXXXX~~. And maybe I'm mistaken; maybe political processes never work well enough to be able to reach such accommodations; that if we had a -- that if we attempted a mere ~~XXXXXXXXXXXXXX~~ rationalization of this question, we would simply end up with an ever-growing increase in ~~XXXXXXXXXX~~ state power and could not make the new ~~XXXXXXXXXX~~ accommodations that encompass the new technologies that would retain the existing equilibrium.

The evolutionary theory of that relationship would suppose that you will never be able to get by rational design what you have managed to get by gradual mutual accommodation and very grave tension between the individual and his society. This may be true, but I think the matter does deserve somewhat more rational examination than it's received in the past -- and

I guess I would prefer to see that manifest criminals were tried, and that if there are injustices in the way that they're dealt with, that this be faced squarely, rather than the kind of evasion that says, " Well, maybe it's just as well if the police don't always get their man," because the result of that frustration is, of course, an increasing appeal to extralegal methods, and in the end it may well lead to a complete breakdown of society.

I haven't <sup>explored</sup> ~~explored~~ all of the problems in this or any of ~~the~~ the other arenas, but simply touched some of those in which there are areas of valid contention about the good of knowledge.

The final one is one in which I believe there are the most ambiguities, although many have no doubts whatsoever, and this is the role of science and of technology with respect to the powers of states; that is, to the role of interstate conflict ~~conflict~~. One hears again and again and again that an evidence that physics has outrun our capacity for moral control has been the development of nuclear weapons.

Now we're all afraid of the bombs, and we know all too well what might happen if they were let loose -- and this is a subject which certainly deserves at least some ambivalence. The actual history of the time since World War II has been one where the great states have been afraid to make war on a large scale. The conflicts have spilled out in the most detestable fashion at all kinds of other levels, but the objective fact



of the situation is that some 25 millions of people were killed in World War II, some 15 or 20 millions of people were killed in World War I, and all -- all of ~~the~~ World War I and almost *all* of the World War II -- without benefit of nuclear weapons.

It's

~~XXXX~~ not plain to me that the good of the world has been significantly altered by this particular bit of knowledge or of power, and it is even conceivable that it is beginning to achieve the aim of showing the utter irrationality of that kind of conflict, and the kinds of assertions that were made <sup>example</sup> some ten years ago, of which I will give an ~~example~~ and quote, were not necessarily instances of authentic discourse.

I've made some prognostications about the future, and I will not give them the validity of scientific authenticity. Lord Snow -- C. P. Snow -- about eleven years ago, made the assertion that it was a scientific fact, as sure as anything that could be demonstrated in the laboratory, that if nuclear weapons still existed ten years from then, that one of them surely would have gone off accidentally. As far as I'm aware, that has not happened. That was a prediction that he was entitled to offer as a suggestion for your contemplation; it certainly did not have the rigor of a scientific demonstration. But then, neither did very much of what I had to say this evening.

I've presented to you a program for your own contemplation and criticism. I hope we do not react too defensively,

as I sometimes have. I'm a product of my own culture. My scientific thinking is very much a product of my own social environment. But that does not totally prevent me from trying to bring up a number of issues for more thoughtful examination and less polemical and angry obfuscation than has been true in the past. And I <sup>thank</sup> ~~THANK~~ you very much for your patience.

(APPLAUSE)

MAN (ALECT: Doctor Lederberg, the applause is far more expressive of our deep appreciation for your delivering the first William S. Paley lecture than any words of mine. I would like, in concluding, to express my gratitude to President <sup>8212</sup> Sites(?) for allowing us to hold this lecture in Caspary Auditorium, not only because of its intimate beauty, but because Doctor Lederberg's magnificent lecture had indeed extended beyond the narrow confines of a department of medicine or single medical center; it has embraced the concerns of the entire academic community and society as a whole.

Doctor Lederberg, once again we thank you. The ~~W~~ William S. Paley <sup>Lectures</sup> ~~LECTURES~~ have tonight been splendidly inaugurated.

(APPLAUSE)

END